Automatic Vehicle Location (AVL) / Human Service Transit

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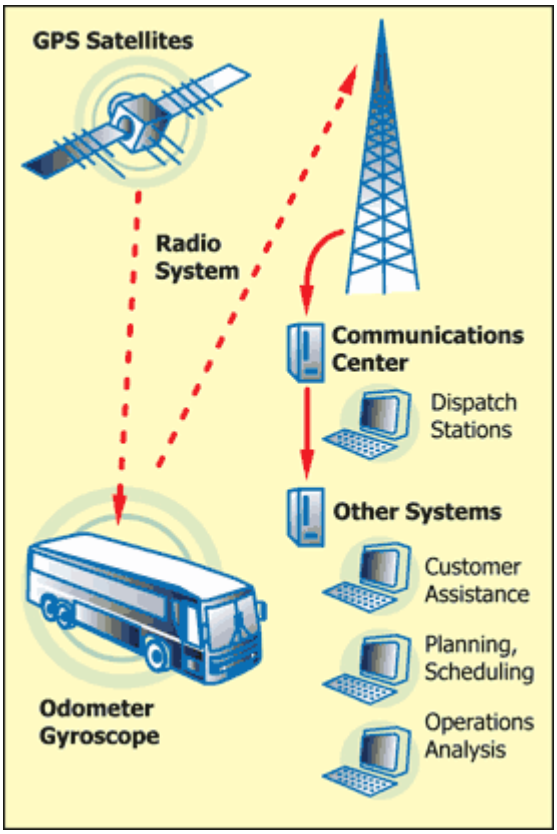
Technology Overview

Automatic Vehicle Location (AVL) systems calculate the real-time location of any vehicle equipped with a Global Positioning Satellite (GPS) receiver. Data are then transmitted to the transit center with use of radio or cellular communications and can be used immediately for daily operations as well as archived for further analysis.

Use AVL to:

- Enhance communication between vehicles and control center
- Optimize demand-response scheduling
- Provide real-time traveler information



As a stand-alone technology, an AVL system can be used to monitor on-time performance. When combined with other technologies, AVL can deliver many benefits in the areas of fleet management, service planning, safety and security, traveler information, fare payment, vehicle component monitoring, and data collection. Since the greatest benefits from AVL are achieved by combining it with other Intelligent Transportation System (ITS) technologies, AVL is most appropriate for **large rural agencies** with more than 30 vehicles that plan to implement a comprehensive ITS.

Common Technology Combinations

Daily Operations

Many rural transit agencies provide demand-response service. Combined with Computer-Aided Dispatch and Scheduling (CADS) and Geographic Information Systems (GIS), AVL allows vehicles to be rerouted in real time to accommodate schedule changes and optimize the number of trips provided. Agencies often realize reductions in nonrevenue miles, passenger wait times, and fleet size. With the addition of Mobile Data Terminals (MDT), drivers can be provided with maps and directions for each segment of their route.

Safety and Security

Many AVL systems incorporate **silent alarms** which allow drivers to covertly alert transit management and police of emergency situations. The vehicle location is displayed on a GIS map to facilitate incident response.

More Technology Facts

Fare Payment and Cost Allocation

One barrier to coordinated human services transit is the challenge of allocating costs appropriately among agencies. **Smart Card Identification (ID)** or fare cards integrated with AVL systems allow agencies to be billed on the basis of the number of trips and the distance of each. Data provided by such a system can increase access to travel patterns for systems planning and can streamline reporting.

Maintenance

Ottumwa Transit Authority uses its AVL/MDT system to relay mechanical information about vehicles remotely. This allows maintenance staff to monitor the needs of remotely garaged vehicles.

Factors to Consider

Adequate Resources

- Capacity for data transmission and storage.
- Staff resources to analyze data and maintain and manage AVL system.

AVL can be paired with SmartCard Readers for easier, more efficient fare collection. This can make fare payment easier for older or disabled passengers and allow transit to keep on schedule.

Integration

- Interoperability with existing and planned technologies of all partnering agencies.
- Flexibility to add agencies and vehicles.
- Clearly defined responsibilities among agencies.

Implementation

- Testing technology on a subset of vehicles.
- Contracting for adequate training of all staff.
- Allowing for more time to implement than anticipated.

AVL systems are a core technology only for large human services agencies or brokerages (those with 50 or more vehicles) or medium-sized urban agencies, for which trip lengths are inconsistent and vehicle use is high. Since human services transit has more information about its passengers and their travel patterns than do most types of transit, AVL should be considered only by agencies that can benefit from the efficiencies afforded by real-time scheduling.

Benefits and Costs

Benefits

- Kansas City achieved reduced incident-response time, from 7-15 to 2-3 minutes, with use of AVL.
- San Jose reduced paratransit expenditures from $4.88 to $3.72 per passenger trip.
- London (Ontario) saved $45,000 annually by eliminating manual schedule adherence checking.
- Sweetwater County, WY, almost doubled ridership without increasing dispatching staff by implementing AVL and CADS. Operating expenses decreased 50% per passenger mile.
- AVL and CADS allowed St. John's County Council on Aging in Augustine, FL, to reduce its scheduling, dispatching, and billing staff by half. Trips per vehicle hour have increased from 0.5 to 2.5.
- Collects driver log for use by payroll and passenger information for billing.
- Kansas City achieved reduced incident-response time, from 7-15 to 2-3 minutes, with use of AVL.

GIS maps can be provided to drivers using MDTs to direct them to their next stop.

- Ann Arbor saw voice-radio traffic reduced by 70% with use of AVL and MDTs.
- London (Ontario) saved $45,000 annually by eliminating manual schedule adherence checking.
- Collects driver log for use by payroll.

Costs

Product Cost

Onboard GPS equipment ranges from $500 to $2,000 per vehicle; complete implementation costs (including control center hardware, installation, and training) range from $ 4,000 to $10,000 per vehicle. Required upgrades to communications systems can add significant costs. Additional ITS applications (CADS, real-time traveler information systems, automatic passenger counters (APC), automatic fare cards (AFC), video surveillance, silent alarms) are not included in these costs.

Operations and Maintenance

AVL alone provides limited operational savings. It facilitates communications and reporting and can improve systems planning. More significant savings are seen with the addition of CADS, which provides the ability to serve more

customers with existing resources. Additional technology specialists are often needed to develop, manage, and maintain ITS systems. Consultants and manufacturers can provide some technical assistance, but in-house staff members are more effective for all but the smallest agencies.

Transit Agency Deployments

Agency	Contact Information	Number of Vehicles	Context / Success of Deployment
Northern Shenandoah Valley Public Mobility Program	1401 East Broad St. Richmond, VA 804-786-6677	10	Used web-based vehicle dispatching paired with AVL to coordinate vehicles among 10 area agencies.
Cape Cod Regional Transit Authority	P.O. Box 1988 Hyannis, MA 508-775-8504	80	Added AVL to existing CADS, which is accessible to customers via a web-based vehicle location system.
Santa Clara Valley Transit/Outreach	3331 North First St. San Jose, CA 800-894-9908	43	Added two new GIS and CADS systems, which simplified and improved communications among control center, passengers, and management.
Wheels of Wellness	928 Market St. Philadelphia, PA 215-563-2000	229	Installed AVL and CADS systems, which enhanced security and communications among agencies. AVL also facilitated trip auditing and billing.

Additional Resources

- Mobility Services for All Americans FTA-ITS Joint Program Office Website (September 2007) http://www.its.dot.gov/itsweb/msaa/index.htm
- ITS Applications for Coordinating and Improving Human Services Transportation – A Cross-Cutting Study (August 2006); http://www.itsdocs.fhwa.dot.gov/jpodocs/REPTS_TE/14140.htm
- Advanced Public Transportation Systems: State-Of-The-Art Update 2006 (March 2006), http://www.fta.dot.gov/documents/APTS_State_of_the_Art.pdf
- Mobility Services for All Americans – Phase 2: Foundation Research (July 2005); http://www.its.dot.gov/msaa/msaa2/index.htm
- Best Practices for Using Geographic Data in Transit: A Location Referencing Guidebook - Defining Geographic Locations of Bus Stops, Routes and other Map Data for ITS, GIS and Operational Efficiencies (April 2005); http://www.fta.dot.gov/assistance/research/research_4611.html
- Geographic Information Systems: Applications in Transit - TCRP Synthesis 55 / Project J-7 (2004); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_syn_55.pdf
- ITS: Helping Public Transit Support Welfare to Work Initiatives (May 2002); Upper Great Plains Transportation Institute; http://www.mountain-plains.org/pubs/pdf/MPC02-131.pdf
- Handbook of Automated Data Collection Methods for the National Transit Database (October 2003), http://www.nctr.usf.edu/pdf/473-11.pdf
- e-Transit: Electronic Business Strategies for Public Transportation (Volume 4) – Advanced Features of Transit Websites - TCRP Report 84 / Project J-0 (2003); http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_84v4front.pdf